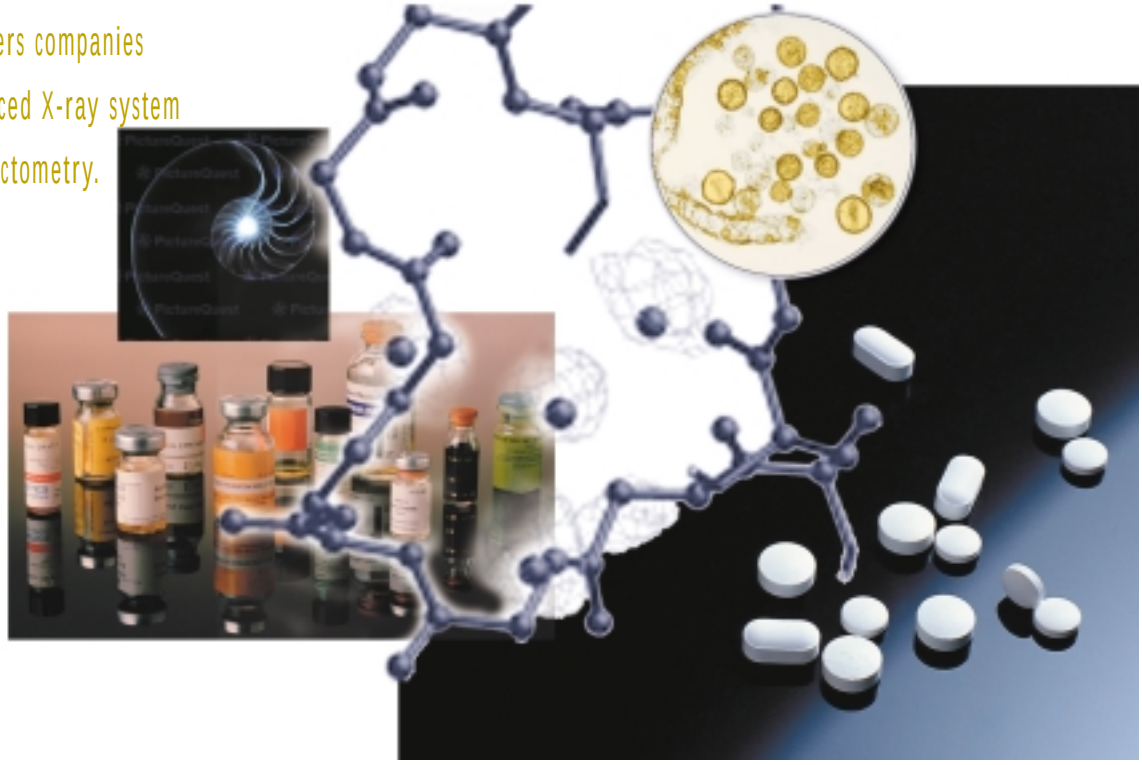
Compact, Low-Power

X-Ray System with Polycapillary Optics

for Crystallography

NASA offers companies an advanced X-ray system for diffractometry.



Developed at NASA Marshall Space Flight Center, this innovative X-ray system is a powerful tool for evaluating diffraction from small crystals—including the most demanding biological macromolecular crystals—and conducting crystallographic studies of their structures. NASA Marshall's X-ray system can deliver a bright, small-diameter X ray that can be maintained easily and channeled efficiently onto the crystal. These features enable higher X-ray flux to be delivered to the crystal sample using less power than conventional systems.

Benefits

- Higher X-ray flux for faster measurements
- Reduced weight
- Reduced size
- Extremely low power consumption
- Decreased maintenance costs

Commercial Applications

- X-ray diffractometry
  - Biological, organic, and inorganic materials
  - Single crystals
  - Microcrystalline samples
- Drug design

National Aeronautics and Space Administration

The Technology

Conventional X-ray macromolecular crystallography systems rely on massive rotating-anode generators that generate a large flux of X rays at power levels of 2,000 W to 18,000 W. Conventional systems also include optics that guide the X rays onto the crystal sample. However, the important X rays for macromolecular crystallography are only a small fraction of the ones that actually strike the crystal sample. In addition, a conventional rotating-anode generator is large and heavy—approximate dimensions of a typical X-ray anode system are 2 m x 2 m x 1 m, with a mass of at least 500 kg. Each of the major parts of the system requires complicated maintenance that could result in multiple disruptions to the system's expected continuous operation.

NASA Marshall Space Flight Center has developed a high-flux X-ray system for macromolecular crystallography. It combines a microfocus X-ray generator (40 mm full width at half-maximum [FWHM] spot size at a power level of 40 W) and a collimating polycapillary optic and produces a small-diameter quasi-parallel X ray.

Comparative testing demonstrated that this advanced, compact X-ray system is a powerful tool for evaluating diffraction from crystals, including biological macromolecules, and conducting crystallographic studies of their structures. Diffraction data collected with NASA Marshall's polycapillary X-ray optics system were of high quality and could be reduced with standard crystallographic software.

Test Results

- The system created X-ray flux that is comparable to that of state-of-the-art rotating-anode generators used for macromolecular crystallography but used two orders of magnitude less power
- The system created X-ray flux that is 2.6 times higher than that generated by a rotating-anode generator equipped with a graded multilayer monochromator but used over 100 times less power

Partnership Opportunities

This technology is part of NASA's technology transfer program. The program seeks to stimulate development of commercial uses of NASA-developed technologies. Opportunities exist to exchange technical ideas and identify partnership opportunities including licensing, cooperative development, use of unique facilities, and modification of commercial technology.

For More Information

If you would like more information about this technology or about NASA's technology transfer program, please contact:

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